REMARKS

Claims 12-17 are presently pending in the application.

Claims 1, 4, 6 and 8-11 have been rewritten as new claims 12-17, by incorporating the subject matter of claim 9 into claim 1 to form new independent claim 12. New dependent claims 13-17 correspond to previous claims 4, 6, 8, 10 and 11, respectively. Accordingly, the new claims are supported by the previous claims, and no new matter has been added. Entry of the amendments is respectfully requested.

The paragraph at the middle of page 12 of the specification has been amended to correct the number of pieces of unit cell and the number of layers which made up the fuel cell stack of Example 1 of the specification. This amendment merely corrects the example to that which was actually performed in connection with the invention of the present application. As explained in paragraph 4 under EXPERIMENT 1 of the accompanying Declaration of Kazuhito Hatoh under 37 C.F.R. § 1.132 ("Hatoh Declaration"), one skilled in the art would recognize from the conditions of fuel utilization, oxygen utilization and current density described in Example 1 of the specification that 31V (page 13, line 16 of the specification) is the correct total voltage for a 50 unit cell, not for a 100 unit cell. Accordingly, no new matter has been added by the amendment, and entry is respectfully requested.

The Examiner has rejected claims 1, 4, 6 and 8-11 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,284,718 of Chow et al. in view of Japanese Published Patent Application JP 6-132038 (JP '038) for substantially the same reasons as set forth in the previous Office Action. In response to Applicant's previous arguments of June 4, 2004, the Examiner argues (pages 5-6 of the Office Action) that neither Chow et al. nor the present application ascribes any criticality to the respective arrangements of the fuel and oxidant plates, and Chow et al. do not appear to discuss the significance of the arrangement of the plates grouped on respective sides, so that the rearrangement of the plates of Chow et al. would not appear to have an effect on the operation of the fuel cell or the humidification section by using the claimed alternate arrangement of the presently claimed invention. With respect to the thickness of the membrane in the humidifiers, the Examiner argues that Chow et al. state that the membranes used in the fuel cells and the membranes used in the humidifiers are substantially identical (see column 10, line 25), so that the artisan would be sufficiently guided to use the same membrane in

all units. The Examiner therefore concludes that the claimed thickness ranges are rendered obvious by Chow et al. This rejection is again respectfully but strenuously traversed, insofar as it relates to the present claims 12-17, for the reasons set forth in the prior response of June 4, 2004 and the following additional remarks and supporting Declaration under 37 C.F.R. § 1.132.

With respect to the arrangement of the fuel and oxidant humidification units, Applicants dispute the Examiner's conclusion that the rearrangement of the plates of the humidification units into an alternating configuration would be well within the skill of the art and not considered to involve an inventive step (bottom of page 3 of the Office Action). Thus, the Examiner has pointed to no motivation to rearrange the humidification plates into an alternating configuration. Moreover, given that the alternate arrangement is more complex than the grouping of the oxidant humidification flow field plates 41 and the grouping of the fuel humidification flow field plates 42 in separate sections, it cannot reasonably be said that rearrangement of the plates into a more complex alternating configuration would be an obvious or logical rearrangement within the ordinary skill of the art. Therefore, the Examiner's rejection on this ground is unwarranted and again respectfully traversed.

With respect to the thickness of the polymer electrolyte membranes in the unit humidifiers, the Examiner argues that the membrane thickness is recognized by the prior art as being a result-effective variable. The Examiner points to column 7, lines 1-20 of Chow et al. as discussing the merits of a thinner membrane than the 89 μm value disclosed. The Examiner notes that it has been held that the discovery of an optimum value of a result-effective variable in a known process is ordinarily within the skill of the art, citing *In Re Boesch* (see paragraph bridging pages 3 and 4 of the Office Action). Applicants dispute this position of the Examiner on several grounds. First, the holding of *In Re Boesch* is inapplicable, since that case involved a result-effective variable in a process limitation for forming a claimed alloy. In contrast, the present claims do not involve process variables, but are directed to an apparatus with a specific structure.

Second, the Examiner's interpretation of Chow et al. as suggesting or providing motivation to make a membrane thinner than 89 μm is a distortion of the teachings of Chow et al. Thus, at column 7, lines 1-20, Chow et al. teaches that the ion exchange membrane 43 has a conventional thickness of approximately 0.007 inches (178 μm), which was necessary when the

membrane is in an unsupported configuration. Chow et al. go on to state that it is believed that a membrane of reduced thickness can be used if the membrane is supported according to their invention. As support for this belief, Chow et al. recite a performance comparison, showing improved current density with a DOW 2 membrane having a thickness of 0.0035-0.0039 inches (89-99 μm) compared to a DOW 4 membrane having a thickness of 0.0063-0.0066 inches (160-168 μm). Hence, the lowest membrane thickness taught by Chow et al. is 89 μm. There is no teaching or suggestion of using any membrane thickness below 89 μm.

Third, the Examiner's conclusion that the thickness of the membranes is a parameter that is recognized by the prior art as being a result-effective variable is again misplaced. Thus, the merits of a thinner membrane discussed at column 7, lines 1-20 of Chow et al. relate to enhanced current density when using a membrane 43 of reduced thickness in the membrane electrode assembly (MEA). Therefore, even if it is assumed that the membrane thickness is a result-effective variable, the result effected by the variation does not relate to the thickness of the membrane in the humidification section, but instead the result of the variation in the MEA. That is, there is no suggestion in Chow et al. that reducing the thickness of the membranes in the humidification sections would have a similar effect on the current density or any other property of the fuel cell stack.

Fourth, even the reduced thickness of 0.0035 inches (89 μm), disclosed by Chow et al. at column 7, line 16 for the MEA membrane, is far thicker than the 50 μm or less membrane thickness for the unit humidifiers of present claim 12 and more than three times the thickness of the preferred unit humidifier membrane thickness of 25 μm or less specified in claim 14. Therefore, even if Chow et al. could be interpreted as suggesting the same reduced membrane thickness of 89 μm for the humidification membranes as for the MEA membranes, a humidification membrane thickness not exceeding about 50 μm (present claim 12) or a humidification membrane thickness not exceeding 25 μm (present claim 14) is neither taught nor suggested by Chow et al.

For all of these reasons, the Examiner has failed to establish a case of *prima facie* obviousness of the claims. The rejection is therefore unwarranted and should be withdrawn.

Even if a *prima facie* case of obviousness has been established, such *prima facie* obviousness would be overcome by the unexpected results of the membrane thicknesses specified in the present claims. In support of these unexpected results, there is submitted herewith the Declaration of Kazuhito Hatoh (one of the present inventors) Under 37 C.F.R. § 1.132, demonstrating the criticality of the thickness of the second (unit humidifier) polymer electrolyte membrane and the unexpected results obtained using a membrane thickness not exceeding about 50 μm, and preferably not exceeding 25 μm.

The Hatoh Declaration is believed to be self-explanatory and will not be repeated here at length. However, the Hatoh Declaration describes in EXPERIMENTS 1 and 2 the reproduction and testing of a fuel cell stack according to Example 1 of the present specification to show the effect of membrane thickness in the unit humidifiers on initial battery voltage and durability life of the battery voltage. As shown in Graphs 1 and 2, the curves for cell voltage and durability life are relatively flat for membrane thicknesses above about 50 μm. In contrast, both initial cell voltage and durability life of the initial battery voltage increase sharply below about 50 μm, reaching an initial cell voltage of about 0.62 to 0.64V (31-32V for the entire 50 unit stack) with a membrane thickness of the unit humidifier of about 25 μm and a durability life greater than 5,000 hours for a fuel cell stack having a membrane thickness of the unit humidifier around 25 μm.

Neither of these results is taught, suggested or expected from the prior art relied upon by the Examiner. Accordingly, any possible case of *prima facie* obviousness is overcome by these unexpected results, and reconsideration and withdrawal of the rejection are therefore respectfully requested.

In view of the above Amendments and Remarks, it is submitted that all of the claims in the application patentably distinguish over the prior art relied upon by the Examiner. Accordingly, reconsideration and withdrawal of the rejections and an early Notice of Allowance are respectfully solicited.

Respectfully submitted,

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(Date)

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